Catches of Downstream Migrating Fish in Fast-flowing Rivers Using Rotary Screw Traps

G.J. Chaput and R.A. Jones

Fisheries and Oceans Canada
P.O. Box 5030
Moncton, NB
E1C 9B6
CANADA

2004

Canadian Manuscript Report of Fisheries and Aquatic Sciences 2688

Fisheries and Oceans / Pêches et Océans

Canada

Canadian Manuscript Report of Fisheries and Aquatic Sciences

Manuscript reports contain scientific and technical information that contributes to existing knowledge but which deals with national or regional problems. Distribution is restricted to institutions or individuals located in particular regions of Canada. However, no restriction is placed on subject matter, and the series reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries and aquatic sciences.

Technical reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report is abstracted in *Aquatic Sciences and Fisheries Abstracts* and indexed in the Department's annual index to scientific and technical publications.

Numbers 1-900 in this series were issued as Manuscript Reports (Biological Series) of the Biological Board of Canada, and subsequent to 1937 when the name of the Board was changed by Act of Parliament, as Manuscript Reports (Biological Series) of the Fisheries Research Board of Canada. Numbers 901-1425 were issued as Manuscript Reports of the Fisheries Research Board of Canada. Numbers 1426-1550 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Manuscript Reports. The currrent series name was changed with report number 1551.

Manuscript reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page. Out-of-stock reports will be supplied for a fee by commercial agents.

Rapport manuscrit canadien des sciences halieutiques et aquatiques

Les rapports manuscrits contiennent des renseignements scientifiques et techniques qui constituent une contribution aux connaissances actuelles, mais qui traitent de problèmes nationaux ou régionaux. La distribution en est limitée aux organismes et aux personnes de régions particulières du Canada. Il n'y a aucune restriction quant au sujet; de fait, la série reflète la vaste gamme des intérêts et des politiques du ministère des Pêches et des Océans, c'est-à-dire les sciences halieutiques et aquatiques.

Les rapports manuscrits peuvent être cités comme des publications complètes. Le titre exact paraît au-dessus du résumé de chaque rapport. Les rapports manuscrits sont résumés dans la revue *Résumés des sciences aquatiques et halieutiques*, et ils sont classés dans l'index annuel des publications scientifiques et techniques du Ministère.

Les numéros 1 à 900 de cette série ont été publiés à titre de manuscrits (série biologique) de l'Office de biologie du Canada, et après le changement de la désignation de cet organisme par décret du Parlement, en 1937, ont été classés comme manuscrits (série biologique) de l'Office des recherches sur les pêcheries du Canada. Les numéros 901 à 1425 ont été publiés à titre de rapports manuscrits de l'Office des recherches sur les pêcheries du Canada. Les numéros 1426 à 1550 sont parus à titre de rapports manuscrits du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom actuel de la série a été établi lors de la parution du numéro 1551.

Les rapports techniques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement auteur dont le nom figure sur la couverture et la page du titre. Les rapports épuisés seront fournis contre rétribution par des agents commerciaux.

104-05809/

Canadian Mansucript Report of
Fisheries and Aquatic Sciences 2688

2004

CATCHES OF DOWNSTREAM MIGRATING FISH IN FAST-FLOWING RIVERS USING ROTARY SCREW TRAPS

by

G.J. Chaput and R.A. Jones

Fisheries and Oceans Canada
Gulf Fisheries Centre
P.O. Box 5030
Moncton, NB
E1C 9B6

E-mail: chaputg@dfo-mpo.gc.ca

© Her Majesty the Queen in Right of Canada, 2004.
Cat. No. Fs 97-4/0000E ISSN 0706-6473

Correct citation for this publication:

Chaput, G.J. and Jones R.A. 2004. Catches of downstream migrating fish in fast-flowing rivers using rotary screw traps. Can. Manuscr. Rep. Fish. Aquat. Sci. 2688: v + 14 p.

TABLE OF CONTENT

Introduction 1

Materials and Methods 1

Results 2

Discussion 4

Acknowledgements 5

References 6

Table 1. Rotary screw trap specifics and site characteristics where traps were installed in five New Brunswick rivers. 7

Table 2. Fish species observed in the catches of the rotary screw traps from five rivers in New Brunswick. Values are percentage of species catches in total catch of all species for each river and installation. Scientific names and common names are from Scott and Crossman (1973). 8

Figure 1. Front view of a rotary screw trap showing Archimedes screw within the metal drum (upper), rotary screw trap installed at the Kedgwick River site, 2002 (middle) and rotary screw trap, with auxillary wings, on the Nashwaak River (bottom). 9

Figure 2. Association between outside rim velocity (m/s) of the drum and revolutions per minute of the drum for three drum diameters (m) of rotary screw traps 10

Figure 4. Examples of length frequency distributions Atlantic salmon juveniles (upper panel), sea lamprey ammocoetes (middle panel) and American eel (lower panel) catches in rotary screw traps during the spring season. 12

Figure 5. Timing of catches of sea lamprey (upper panel, Kedgwick River 2003), Atlantic salmon (middle panel, Kedgwick River 2003) and American eel (lower panel, Restigouche River 2003) in the rotary screw traps. 13

Figure 6. Timing of catches of four common species at the rotary screw traps on the Restigouche River in 2003. The last day of operation in 2003 was 23 June 14

Chaput, G.J. and Jones R.A. 2004. Catches of downstream migrating fish in fast-flowing rivers using rotary screw traps. Can. Manuscr. Rep. Fish. Aquat. Sci. 2688: v + 14 p.

ABSTRACT

The rotary screw trap provides a method of capturing fishes in fast flowing waters with minimal impact on the environment. A rotary screw trap is a passive sampling gear which takes advantage of flowing water to capture and retain downstream migrating fish. The gear is non-size and non-species selective. In sampling from five rivers in New Brunswick (Canada) during the spring and fall seasons, over 20 species of fishes were captured including Atlantic salmon (*Salmo salar* L.), various species of small cyprinids (dace, chub, shiner), suckers (*Catastomus* sp.), American eel (*Anguilla rostrata* L.), and sea lamprey (*Petromyzon marinus L.*). The size of fish sampled in the traps ranged from emerging salmon fry at 3 cm fork length to adult American eels at over 85 cm in total length. Catches at the traps provided descriptions of downstream fish movements in the spring and fall, variations in species presence and relative abundance among years, within a river system and among rivers.

RÉSUMÉ

Un piège à poisson du genre de trappe rotative permet de capturer des poissons dans les eaux à courant élevé avec un minimum d'impact sur l'environnement. La trappe rotative est un engin de pêche passif qui utilise les courants d'eau afin de capturer et retenir des poissons en dévalaison. L'engin n'est pas sélectif, ni pour la taille, ni pour l'espèce. Plus de 20 espèces de poisson ont été capturées dans cinq rivières du Nouveau-Brunswick (Canada) au printemps et à l'automne. Parmi les espèces capturées, on note le saumon atlantique (*Salmo salar* L.), plusieurs espèces de petits cyprinides (naseux, mulet, méné), des meuniers (*Catastomus* sp.), l'anguille d'amérique (*Anguilla rostrata* L.), et la lamproie de mer (*Petromyzon marinus L.*). L'envergure de taille des poissons capturés recouvrait les alevins émergents de saumon d'environ 3 cm de longueur jusqu'à l'anguille d'amérique de plus de 85 cm de longueur totale. Les captures dans les trappes rotatives ont permis de décrire les mouvements en aval des poissons au printemps et à l'automne ainsi que les variations de représentation et d'abondance relative annuelles et géographiques, intra- et inter-rivière.

INTRODUCTION

Unlike more visible and audible fauna, such as birds, the detection and quantification of abundance of fishes remains a challenge. Water is a difficult medium within which to work due to its density, opacity and inertia. A diverse array of methods have been developed for the capture of aquatic organisms, mostly resulting from the ingenuity of humans to satisfy their need for food. Efficient gears have been developed for the sampling of a broad range of marine pelagic and benthic communities (Benoît et al. 2003). Sampling of moving waters, as for example in rivers, poses a different challenge as the energy of the moving water has restricted the type of gears and the conditions under which they can be used. A broad range of rigid structures have been developed for filtering moving water and redirecting fish into holding traps (Hardie et al. 1998; Hayward 2001; Murphy and Willis 1996) but most gears become ineffective and inoperable under high and turbid water conditions. Gears designed to operate under very high flows tend to have a coarse filtering mechanism which precludes the trapping of small bodied fishes (Hayward 2001). This constraint limits the sampling which can be conducted during periods of high water flow such as in the spring and fall seasons, especially for small bodied fishes.

In the 1980s, rotary screw trap technology was developed on the west coast of North America to sample in flowing waters (McLemore et al. 1989). These traps have most frequently been used on studies of salmonids (Baillie 1994; Chaput et al. 2002; Kennen et al. 1994; Miller and Sadro 2003; Thedinga et al. 1994). Our recent experience with rotary screw traps has provided new information on the downstream movements of fish species and life stages in rivers, data which were difficult to obtain prior to the development of these gears. In this paper, we provide details of some of the sampling initiatives which demonstrate the kinds of information on fish movements and characteristics which can be obtained using rotary screw traps.

MATERIALS AND METHODS

A rotary screw trap (RST), also known as auger trap, is a passive sampling gear which takes advantage of the energy in flowing water to assist in the capture and retention of downstream migrating fish. The operating mechanism of a rotary screw trap consists of a cylinder/cone (drum) arrangement with an Archimedes screw as its central axis. The axis is orientated parallel to the water surface and into the direction of flow (Fig. 1).

The rotary screw traps were of three sizes; 1.52 m (5 ft), 1.83 m (6 ft) and 2.44 m (8 ft.) diameter drum. The drums of the 1.52 m and 2.44 m diameter RSTs were covered with small diameter (6 mm) punched aluminum (EG Solutions Inc. http://www.screwtraps.com). The drum of the 1.83 m diameter RST was covered with an aluminum wire mesh of 6mm on a square (Pisces Research Corp. Vancouver, Canada). The drum and holding box in both models are constructed of aluminum and attached to side pontoons which maintain the gear at the surface of the water. The floating gear was kept in place by instream anchors or more frequently using an overhead shorefast cable. The 1.52 and 2.44 m diameter rotary screw traps

have a rotating drum integrated in the back wall of the holding box, propelled by the Archimedes screw, which removes debris from the holding box.

The energy of flowing water is translated by the Archimedes screw into rotation of the drum which transports water and fish back to the cone and into a holding box. Only half of the diameter of the drum is in the water. The effective area of water sampled depends on the drum diameter. The 1.52 m diameter gear fishes an effective depth less than 0.75 m and an effective area less than 1.8 m^2. The 2.44 m diameter gear fishes an effective depth less than 1.2 m and an effective area less than 4.7 m^2. The speed of the rim of the drum is determined by the rate of revolutions of the drum (RPM) and the diameter of the drum (Fig. 2). Outside rim velocities of 1 m/s occur at an RPM of 8 for the 2.44 m diameter unit whereas 12 RPM are required to achieve the same outside rim velocity on the 1.52 m diameter gear.

The rotary screw traps were installed in medium to large rivers (stream order 5 to 7), ranging in width from 50 to 125 m (Table 1). The Kedgwick River is a tributary of the Restigouche River and like the Little Southwest (LSW) Miramichi River, they empty into the Gulf of St. Lawrence (Fig. 3). There are no obstructions to fish migration in these rivers. The Nashwaak River and Tobique River are tributaries of the Saint John River which empties into the Bay of Fundy (Fig. 3). The Tobique River is located upstream of three hydro-electric dams on the Saint John River whereas the Nashwaak River is located downstream of all the dams.

In most cases, wheel speed (revolutions per minute - RPM), water temperature and water level were recorded daily during the period of operation (Table 1). Depth of water at the trap varied within the period of operation. Water level changes during the time of operation were generally less than one and a half metres (Table 1). Water temperatures during the spring monitoring program increased from about 2 to 4°C to over 20°C in some locations (Table 1). Water temperatures during the fall monitoring program on the Tobique decreased from 18 °C to near freeze-up by the end of operations (Table 1).

Rotary screw traps were generally monitored once per day, in the morning. Fork lengths were obtained from a proportion of Atlantic salmon captured at all locations whereas total lengths were obtained from all American eel (*Anguilla rostrata* L.) and sea lamprey (*Petromyzon marinus* L.) captured at the Miramichi and Restigouche rotary screw traps. Other fish were identified to an individual species or genera, counted and released. Identifications and species classifications are based on Scott & Crossman (1973).

RESULTS

Collectively, the traps sampled over 20 species of fishes (Table 2). In addition to the target species and life stage of interest (i.e. Atlantic salmon smolts and pre-smolts), important movements of other species and life stages were noted including large numbers of non-smolting juvenile Atlantic salmon, sea lamprey ammocoetes, American eel, and numerous small bodied fish species (Table 2). Most species were observed in both geographic areas although in varying proportions within each river. A few species were unique in the catches from the Bay of Fundy rivers; lake whitefish (*Coregonus clupeaformis* M.), yellow perch (*Perca flavescens* M.), smallmouth bass (*Micropterus dolomieui* L.), brown bullhead (*Ictalurus nebulosus* L.), longnose sucker (*Catastomus catastomus* F.), and burbot (*Lotta lotta*

L.) (Table 2). Four species were sampled uniquely from the Gulf of St. Lawrence rivers; round whitefish (*Prosopium culindraceum* P.), American shad (*Alosa sapidissima* W.), banded killifish (*Fundulus diaphanous* L.), and slimy sculpin (*Cottus cognatus* R.) (Table 2).

There were also differences in the species composition of the catches at different locations within the major river systems. Sea lamprey and gaspereau (*Alosa* sp.)were not captured at the Tobique River traps but were captured in the Nashwaak River which is indicative of the fish passage constraint for these species above the dams on the Saint John River (Table 2). In the Restigouche River, rainbow smelt (*Osmerus mordax* M.) and banded killifish were only observed at the lower traps (Table 2). The relative proportions of sea lamprey and Atlantic salmon captured were much higher at the upstream Kedgwick River trap whereas rainbow smelt, stickleback, white sucker, chub along with salmon dominated the catches at the lower wheels in the Restigouche River (Table 2). Although relatively abundant in all rivers of New Brunswick, speckled trout were rarely captured migrating downstream during any of the trapping operations (Table 2). Species composition of the catches in the Tobique River were remarkably similar during spring and fall sampling events (Table 2).

The rotary screw traps sampled various lifestages of downstream migrating fish. Atlantic salmon catches were dominated by smolt and parr life stages, ranging between 4 and 20 cm fork length (Fig. 4). Towards the end of the spring sampling program in late May to mid-June, emergent and drifting young of the year salmon measuring between 2.5 and 3.5 cm were captured at all the trapping facilities with the exception of the Tobique. Juvenile stages of sea lamprey dominated the catches including both free-living ammocoetes and newly metamorphosed parasitic stages (Fig. 4). A few adult sea lamprey were captured at the Nashwaak River trap. American eel were of a broad size range, 10 to 85 cm total length (Fig. 4). The size distribution of the American eel catches from the Nashwaak was similar to that observed on the Kedgwick and Restigouche (Fig. 4) while the few (less than 1% of catch) eels captured on the Tobique were large (estimate to be greater than 65cm). The gaspereau, American shad, and rainbow smelt catches in the Gulf of St. Lawrence rivers and the Nashwaak River were of spawning or post-spawned adults. The majority of white sucker (*Catastomus commersoni* L.) catches in both the Gulf of St. Lawrence and Bay of Fundy rivers were juvenile stages less than 10 cm fork length. The majority of the dace, chub, shiner, and stickleback catches were small-bodied and would have included both juveniles and adults.

The water temperatures at the commencement of spring sampling were generally less than 5°C (Table 1). Even at these low water temperatures, numerous fish species were captured in the traps. The movement of Atlantic salmon smolts in the spring is a directed downstream migration. The large catches of one-year old salmon parr, particularly in the Kedgwick River, were unexpected as were the downstream drift of free-living lamprey ammocoetes, and eels (Fig. 4, 5). Movements of cyprinids and sticklebacks increased with the progression of the season and their ultimate destination, either localized movements or a directed migration further down to the estuary, was unknown (Fig. 6).

The rotary screw traps were operated as part of studies to estimate the size of the smolt run of Atlantic salmon. The trap in the Kedgwick River in 2003 was estimated to have intercepted almost 3% of the run (95% confidence interval 2.1%-3.7%) whereas the two lower traps in the Restigouche River in 2003 combined intercepted about 1% (95% confidence interval 0.6% to 1.6%) of the smolt run. In the Nashwaak River, the rotary screw trap with auxiliary wings (Fig. 1) has intercepted between 7% and 11% of the salmon smolt run annually.

The rotary screw traps partially delay the migration of the captured fish, for at most less than 24 hours, but mortalities were minimal. In 2003 on the Restigouche river, only 10 of over 5,600 fish (less than 0.2%) captured at the lower traps, all salmonids, were found dead in the rotary screw trap. In the Kedgwick River trap in 2002, the rate of mortality was less than 0.6% and they were represented by salmonids primarily, plus one stickleback and the only two coregonids captured that year. During five spring seasons of sampling on the Nashwaak, only 0.3% of the total fish captured were mortalities, 66% (n=22) were salmon smolts.

DISCUSSION

The absence of catches of particular species in the rotary screw traps can not be considered indicative of absence of the species in the river. For example, yellow perch, brown bullhead and slimy sculpins were not captured in the Little Southwest Miramichi trap but these species are endemic to the Miramichi River (Hayward 2001). Electrofishing surveys have captured burbot in one tributary of the Restigouche River (G. Chaput, unpubl. data) but none were captured in the Restigouche wheels.

The relative species proportions in the traps cannot be considered indicative of abundance. Round whitefish are common in the Restigouche River, as adults are readily seen in pools throughout the river but few were captured in wheels. Speckled trout are also abundant in all New Brunswick watersheds but were infrequent in the catches of the rotary screw traps. The efficiency of the trap to sample downstream migrating fish would be affected by the behaviour of the fish and would be expected to differ among species. The traps sample the upper portion of the water column and generally the middle of the river. Based on the catches at the traps, a large number of fishes are displaced or migrate downstream in the upper portion of the water column. Our experience has shown that daytime catches of Atlantic salmon smolts and most other fish are minimal during daylight hours. Atlantic salmon smolts are known to migrate predominantly at night (McCormick et al. 1998). For other species, their behaviour has not been well described although we might expect movements of fish to occur more at night than during the day or at depth rather than the near surface to reduce the risk of predation.

The differences in the catches of sea lamprey and eels in the Tobique and Nashwaak rivers is indicative of the presence of barriers to migration for these species. Juvenile and adult sea lamprey were present only in the Nashwaak River. Mature adult sea lampreys were documented in the thousands on the Tobique River during the 1950's (Smith 1979) but since the construction of hydroelectric facilities sea lamprey cannot access the upper tributaries of the Saint John and consequently appear to be extirpated from the Tobique River. Only large eels were captured in the Tobique River whereas all size ranges of eels were sampled in the Nashwaak River suggesting that minimal recruitment above the dams to the Tobique River has occurred in recent years.

Rotary screw traps were effective at capturing a diversity of fish species encompassing a broad range of sizes. Even fish such as lamprey ammocoetes which are of very small body circumference were entrained by the screw and drum and retained in the holding box.

American eels are known to be difficult to retain in fishing gears yet were captured in large quantities and over a broad size range in the rotary screw traps.

The rotary screw trap technology provides an unobtrusive and low impact method of sampling fast flowing waters. The traps were installed in the spring following the peak discharge in conditions of water velocities and depths which would have precluded the installation of portable counting fences and numerous other sampling gears. Our experience has been that the traps can be assembled and fishing in less than a day. Although limited to sampling downstream migrating aquatic fauna, the gear can sample a broad diversity of fish species with a wide range of fish body sizes and life stages.

In the context of characterizing biodiversity, rotary screw traps are one of several sampling tools which can provide highly informative data on species presence, characteristics, and movements particularly in running water environments. Because the trap floats on top of the water, there is no disturbance to the substrate and as a result the gear leaves a small environmental footprint. The mortality on captured fish is minimal. These are important considerations in the design of research and monitoring programs and particularly on species at risk and in sensitive habitats.

ACKNOWLEDGEMENTS

Numerous individuals within the Atlantic Salmon Federation, New Brunswick Salmon Council, the New Brunswick Wildlife Council and the Department of Fisheries and Oceans have promoted and demonstrated the importance and benefits of using non-invasive sampling gears for monitoring aquatic resources. In addition to numerous individuals within Fisheries and Oceans Canada, participants in the rotary screw trap operations included: Nexfor Fraser, Listiguij First Nation, Tobique Salmon Protective Association, Northumberland Salmon Protection Association, and Nashwaak Watershed Association. We thank Gary Atkinson, Rod Bradford, Paul Leblanc, and Larry Marshall for their reviews and constructive comments.

REFERENCES

Baillie S.J. 1994. Summary of the 1993 coho salmon smolt trapping operations on the Lachmach River, British Columbia. Can. Data Rep. Fish. Aquat. Sci. 936. 48 p.

Benoît H.P., Abgrall, M.-J., and Swain, D.P. 2003. An assessment of the general status of marine and diadromous fish species in the southern Gulf of St. Lawrence based on annual bottom-trawl surveys (1971-2002). Can. Tech. Rep. Fish. Aquat. Sci. 2472: iv + 183 p.

Chaput G., Hardie, P., Hayward, J., Moore, D., Sheasgreen, J., and NSPA. 2002. Migrations and biological characteristics of Atlantic salmon (*Salmo salar*) smolts from the Northwest Miramichi River, 1998 to 2000. Can. Tech. Rep. Fish. Aquat. Sci. 2415. 70 p.

Hardie P., Cunjak, R.A., and Komadina-Douthwright, S. 1998. Fish movement in Catamaran Brook, N.B. (1990-1996). Can. Data Rep. Fish. Aquat. Sci. 1038. 71 p.

Hayward J. 2001. Weekly fish counts from in-river traps and barrier pools in the Miramichi River, New Brunswick, 1994 to 1999. Can. Data Rep. Fish. Aquat. Sci. 1080. 104 p.

Kennen J.G., Wisniewski, S.J., Ringler, N.H., and Hawkins. H.M. 1994. Application and modification of an auger trap to quantify emigrating fishes in Lake Ontario tributaries. North Amer. J. Fish. Manage. 14: 828–836.

McCormick S.D., Hansen, L.P., Quinn, T.P., and Saunders, R.L. 1998. Movement, migration, and smolting of Atlantic salmon (*Salmo salar*). Can. J. Fish. Aquat. Sci. 55(Suppl. 1): 77-92.

McLemore C.E., Everest, F.H., Humphreys, W.R., and Solazzi, M.S. 1989. A floating trap for sampling downstream migrant fishes. Research note PNW-RN-490, Pacific Northwest Research Station, United States Forest Service, Corvallis, Oregon.

Miller B.A. and Sadro, S. 2003. Residence time and seasonal movements of juvenile coho salmon in the Ecotone and Lower Estuary of Winchester Creek, South Slough, Oregon. Trans. Amer. Fish. Soc. 132: 546-559.

Murphy D.W. and Willis, B.R. (ed.). 1996. Fisheries Techniques, Second Edition, American Fisheries Society, Bethedsa, MD. 732 p.

Scott W.B. and Crossman, E.J. 1973. Freshwater Fishes of Canada. Bull. Fish. Res. Board of Can. 184: xi + 966 p.

Smith K.E.H. 1979. Capture and distribution of all fish species at Saint John River power dams, New Brunswick, from construction years to 1971. Can. Data Rep. Fish. Aquat. Sci. 171: viii + 55 p.

Thedinga J.F., Murphy, M.L., Johnson, S.W., Lorenz, J.M., and Koski, K.V. 1994. Determination of salmonid smolt yield with rotary-screw traps in the Situk River, Alaska, to predict effects of glacial flooding. North Amer. J. Fish. Manage. 14: 837-853.

Table 1. Rotary screw trap specifics and site characteristics where traps were installed in five New Brunswick rivers.

Location	Marine area	Drum diameter (m)	Anchoring system	Latitude (N)	Longitude (W)	Elevation (m)	Stream order
Kedgwick River	Gulf of St. Lawrence	1.52; 2.44	Overhead cable	47° 40'	67° 31'	130	6
Restigouche River	Gulf of St. Lawrence	1.52	Instream anchors	48° 0'	66° 49'	5	7
Little Southwest Miramichi River	Gulf of St. Lawrence	1.52	Overhead cable	46° 53'	66° 05'	80	5
Tobique River	Bay of Fundy	1.52; 1.83	Overhead cable	46° 52'	67° 26'	110	6
Nashwaak River	Bay of Fundy	1.52	Overhead cable	46° 07'	66° 36'	20	5

Location	Dates of operation	Width of river (range - m)	Depth range at trap (m)	Operating range (RPM)	Water temperature[1]	Water level range (cm)
Kedgwick River	8 May to 19 June	50 to 75	2 to 3	5 to 9	2 to 15	100
Restigouche River	14 May to 23 June	Within river channels < 50	2 to 3	4 to 13	3 to 18	86
Little Southwest Miramichi River	2 May to 27 June	100 to 110	0.8 to 1.5	6 to 12	2 to 22	75
Tobique River (Spring- Apr-Jun)	23 April to 5 June	75 to 125	2 to 4	8 to 14	4 to 17	150
Tobique River (Fall – Sept-Nov)	24 Sept. to 16 Nov.	50 to 100	1 to 3	4 to 12	0 to 18	30
Nashwaak River	18 April to 7 June	60 to 75	3 to 5	2 to 14	3 to 21	140

[1] – daily mean temperature (°C) or temperature at sampling

Table 2. Fish species observed in the catches of the rotary screw traps from five rivers in New Brunswick. Values are percentage of species catches in total catch of all species for each river and installation. Scientific names and common names are from Scott and Crossman (1973).

	Nashwaak	Tobique		LSW Miramichi	Restigouche	Kedgwick
	1998-2002	2001-2002		1999-2002	2003	2002-2003
Species	Spring	Spring	Fall	Spring	Spring	Spring
Petromyzon marinus L. (Sea lamprey)	1.9	.	.	2.4	0.2	9.8
Alosa (aestivalis M. *or pseudoharengus* W.) (Gaspereau)	< 0.1	.	.	6.9	0.0	0.1
Alosa sapidissima W. (American shad)	.	.	.	1.5	.	.
Salmo salar L. (Atlantic salmon)	75.3	64.1	60.1	72.4	47.6	85.2
Salvelinus fontinalis W. (Brook trout)	.	.	< 0.1	0.3	<0.1	0.1
Coregonus clupeaformis M. (Lake whitefish)	.	< 0.1	0.7	.	.	.
Prosopium cylindraceum P. (Round whitefish)	.	.	.	.	.	<0.1
Osmerus mordax M. (Rainbow smelt)	.	1.8	0.1	.	6.9	.
Notropis cornutus M. (Common shiner)	11.2[1]	16.2[1]	20.3[1]	2.0	<0.1	<0.1
Rhinichthys atratulus H. (Blacknose dace)	0.4	3.8	0.4	1.1	0.8	1.6[2]
Semotilus corporalis M. (Fallfish)	0.9	.	.	5.8	9.4	0.0
Catastomus commersoni L. (White sucker)	3.0[3]	9.3[3]	17.7[3]	1.4	13.7	0.3
Ictalurus nebulosus L. (Brown bullhead)	< 0.1	.	.	.	.	.
Anguilla rostrata L. (American eel)	6.5	0.4	< 0.1	6.2	2.8	2.3
Fundulus diaphanus L. (Banded killifish)	.	.	.	<0.1	0.1	.
Lota lota L. (Burbot)	< 0.1	0.4	< 0.1	.	.	.
Gasterosteus sp. (Stickleback)	< 0.1	0.4[4]	0.1[4]	<0.1	17.9	0.6
Micropterus dolomieui L. (Smallmouth bass)	0.7	0.2	.	.	.	.
Perca flavescens M. (Yellow perch)	.	3.5	0.6	.	.	.
Cottus cognatus R. (Slimy sculpin)	.	.	.	.	0.2	0.2
Total catch, all species	10833	2968	9404	9477	11672	9004

[1] – Includes *Notropis cornutus* M. (Common shiner) *and Notemigonus crysoleucas* M. (Golden shiner)
[2] – Includes a few *Chrosomus neogaeus* C. (Finescale dace) and *Chrosomus eos C.* (Northern redbelly dace).
[3] – Includes some *Catostomus catostomus* F. (Longnose sucker).
[4] – Mostly *Gasterosteus aculeatus* L. (Threespine stickleback).

Figure 1. Front view of a rotary screw trap showing Archimedes screw within the metal drum (upper), rotary screw trap installed at the Kedgwick River site, 2002 (middle) and rotary screw trap, with auxillary wings, on the Nashwaak River (bottom).

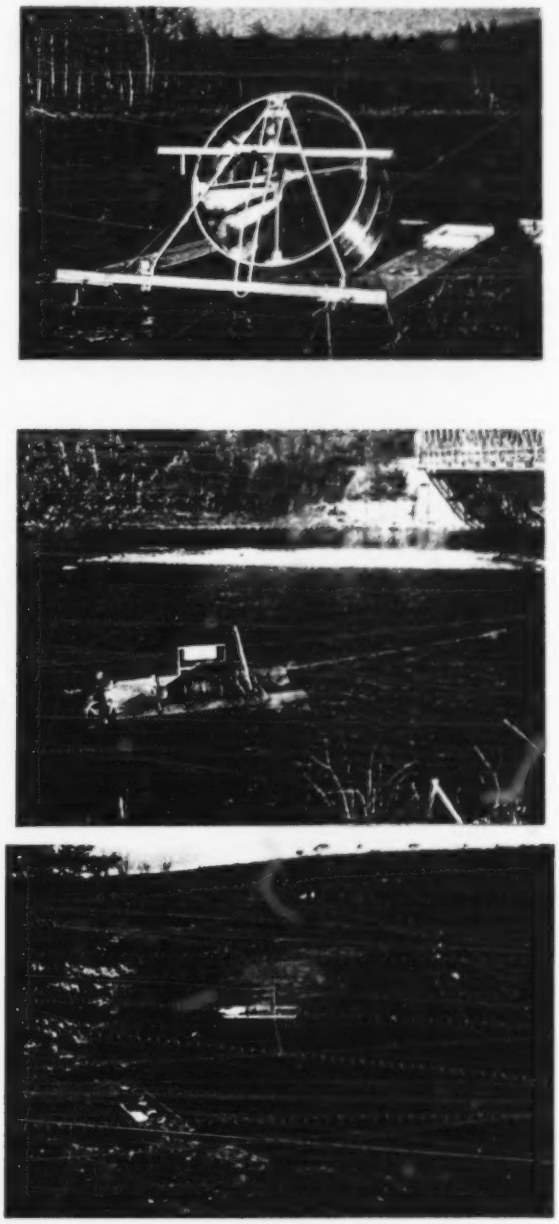

Figure 2. Association between outside rim velocity (m/s) of the drum and revolutions per minute of the drum for three drum diameters (m) of rotary screw traps.

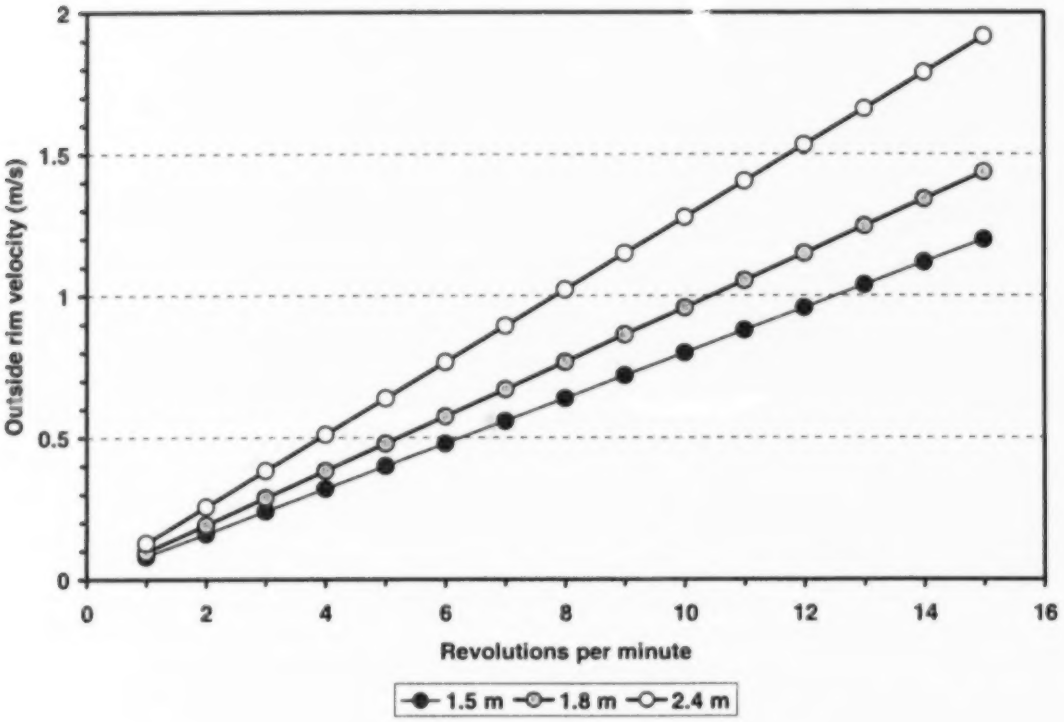

Figure 3. Locations of rotary screw traps within the rivers of New Brunswick.

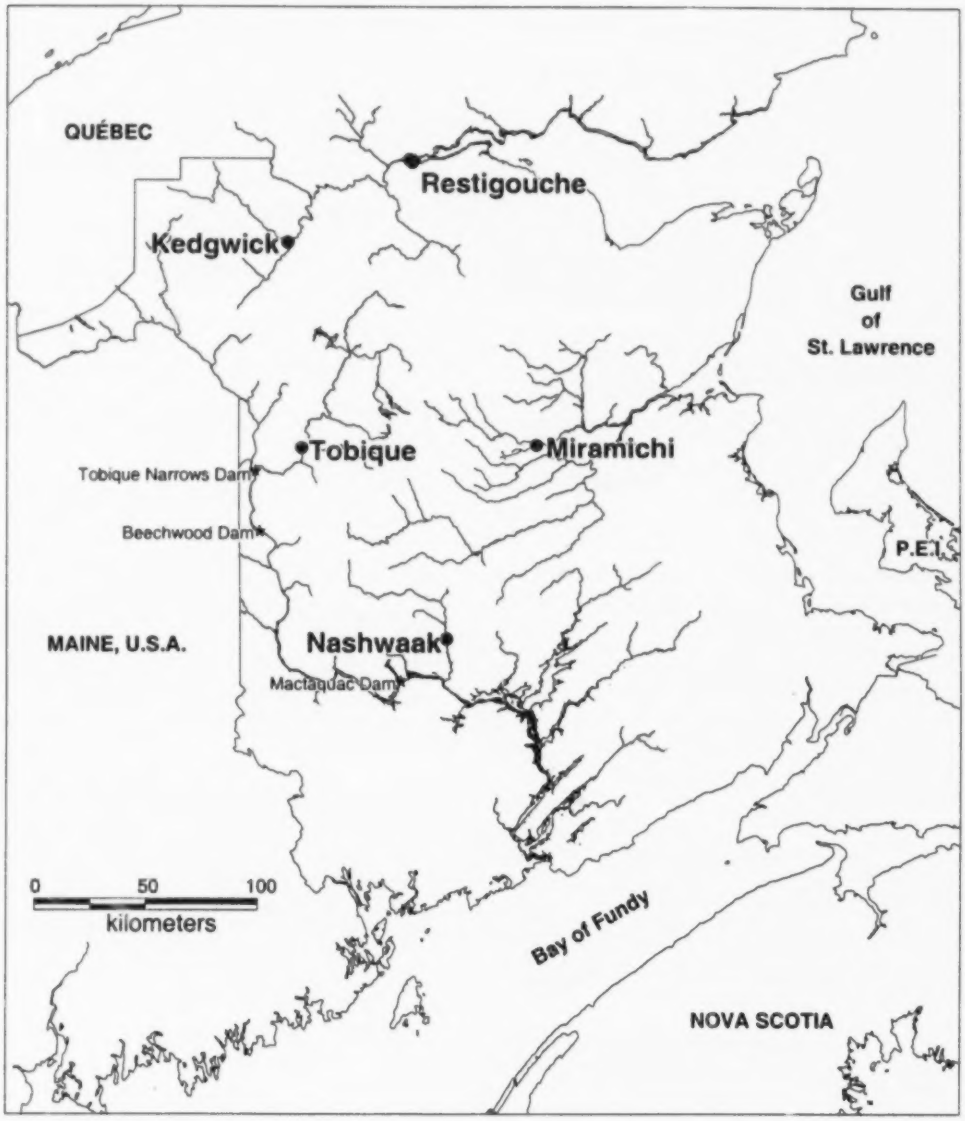

Figure 4. Examples of length frequency distributions Atlantic salmon juveniles (upper panel), sea lamprey ammocoetes (middle panel) and American eel (lower panel) catches in rotary screw traps during the spring season.

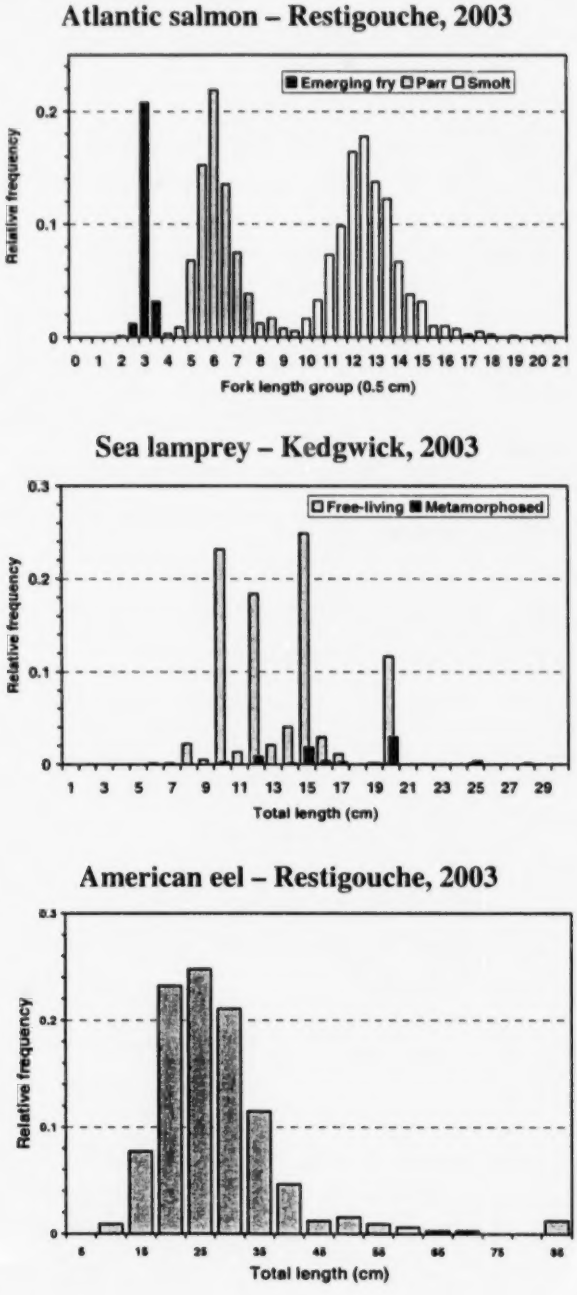

Figure 5. Timing of catches of sea lamprey (upper panel, Kedgwick River 2003), Atlantic salmon (middle panel, Kedgwick River 2003) and American eel (lower panel, Restigouche River 2003) in the rotary screw traps.

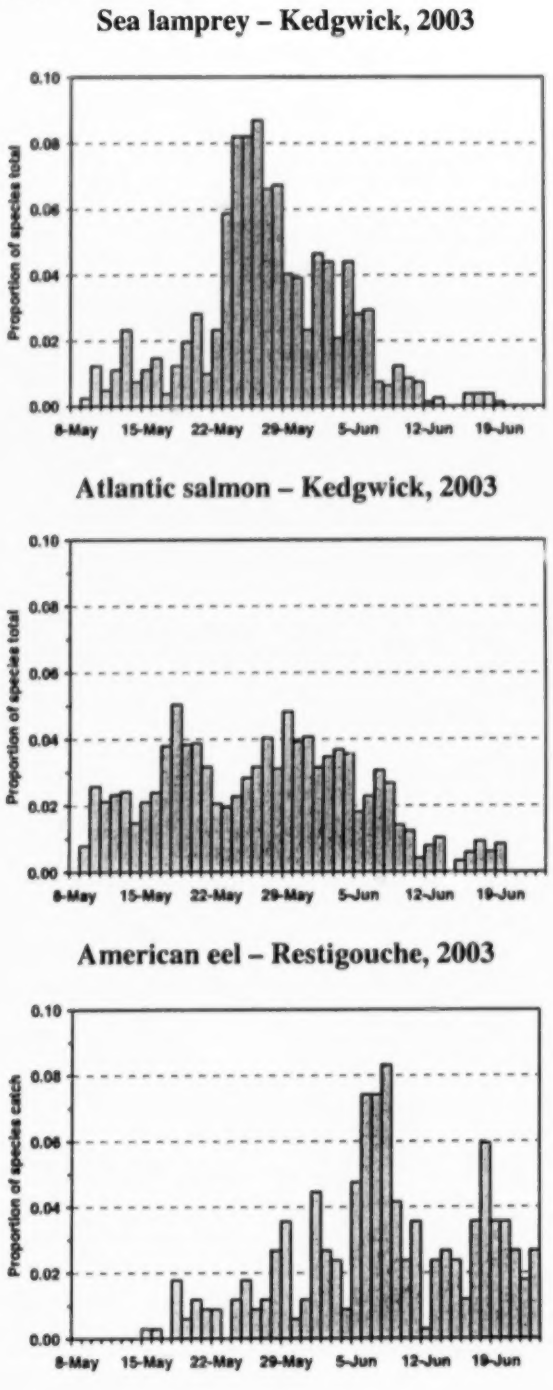

Figure 6. Timing of catches of four common species at the rotary screw traps on the Restigouche River in 2003. The last day of operation in 2003 was 23 June.